Claims

1. This invention uses an adaptive filter to reduce multipath in a radio transmitted signal wherein the multipath is caused by reflections from fixed objects. This method is superior to other methods which methods use correlation.

2. The concept can be extended to reduce multipath in a transmitted signal in which the multipath is caused in part by reflection from moving objects, interferers or targets.

3. In the case of a moving target, the cancellation is accomplished by subtraction of a coefficient times a delay and Doppler shift of the direct path signal. The delay multiplied by the speed of light gives a measure of differential target range. The Doppler shift multiplied by the speed of light gives a measure of differential target range rate. The amplitude of the coefficient is a measure of the magnitude of the target.

4. The two dimensional position and velocity of the target can be calculated by geometric triangulation using one receive antenna and two transmitters. The three dimensional position and velocity of the target can be calculated by geometric triangulation using one receive antenna and three transmitters.

5. The method works best with broadband uncorrelated white signals. Correlation in the signal reduces the accuracy of the measurements. The invention, to improve performance, therefore, uses a prewhitening filter and a post unwhitening filter.

6. Another use of the system is to measure the angle of moving targets. If multiple antennas are provided, each connected with a system as shown in the Figure, the angle of a moving target causing a multipath reflection to the receiving antennas can be measured by using the relative phase of the corresponding delay and Doppler complex coefficients across the several antennas.

7. The receiving antennas, receivers and processing system can be placed in a surveillance aircraft the position and velocity of which is obtained by an accurate navigation system. Objects on the ground, interferers and targets causing multipath reflections can be processed by this system. Target positions and velocities can be obtained by adding the surveillance aircraft position and velocity to the measured position and velocity of the target.